would have to be used with great caution in estimating tramway requirements in Europe. Fortunately there is no need to use American figures at all, since sufficient data are available from European experience. A curve on p. 14 is interesting as showing that with the expansion of towns the mileage of electric lines per 1000 inhabitants goes down, and the yearly number of journeys made by each inhabitant goes up. The figures are not directly applicable to European towns, but the tendency shown by these curves is the same in Europe. Towns of about 40,000 inhabitants show the greatest mileage, namely 0·76 per 1000 inhabitants, but only 110 journeys per inhabitant yearly, whilst towns of one million inhabitants and above have on the average only half a mile of line per 1000, but each inhabitant uses the cars on an average 230 times a year.

It is not clear from the author's figures whether they refer to what we should term tramways or whether they include railways also; the latter is probable, for tables giving mileage, equipment, cost, and earning of electrified main lines are mixed up with the other statistics. The next three chapters are devoted to what the author calls "Electrical Features," and deal with motor capacity and running diagrams. Various methods for getting out these curves are given, namely, Armstrong's, Storer's, and Hutchinson's methods, the latter at some length. The treatment is by no means lucid, formulæ and coefficients being introduced without explanation. Unless the reader is a thorough expert in this subject (when he needs no further instruction from the author) he will make nothing of these chapters.

Altogether the author's mathematics is not characterised by exactitude. Thus, on a later page, when he treats of converters, following (with due acknowledgment) Mr. Hay's method for the determination of the output, we find him calling a line like the following

$$\tfrac{1}{4}I_d^2+\tfrac{1}{2}I_a^2-\tfrac{1}{2}I_a\int_0^{\pi}\cos 2\left(\alpha-\frac{\pi}{n}\right)\pm I_dI_a\int_0^{\pi}\sin\left(\alpha-\frac{\pi}{n}\right)$$

an equation, without saying what it is equal to, and omitting the differential $d\alpha$. It will also be noticed that the third term should contain either the product of two currents or the square of a current, so that the expression is also wrong in the matter of dimension. A reader having Mr. Hay's book at hand will perhaps be able to find his way through the author's mathematics, but without such aid he had better skip the part on p. 195.

The author seems to pin his faith to the system, almost universal in America, of transmitting by three-phase current and converting into continuous current by means of rotary converters in substations. Motor generators, direct working, or the use of boosting batteries are not even mentioned. The important matter of heating of transformers and means of cooling is dealt with in less than two pages of general remarks, but to make up for this we get plenty of catalogue pictures of plant installed by the two leading American companies. Chapter ix., treating of insulating oils, is instructive. On p. 234 a curve is given showing the enormous influence on the insulating property of the oil of even slight traces of moisture, and the specification given on p. 239 should prove useful. GISBERT KAPP.

OUR BOOK SHELF.

(1) *Algebraic Equations.* By G. B. Mathews, F.R.S. Pp. viii+64. (2) *The Theory of Optical Instruments.* By E. T. Whittaker. Pp. viii+72. Cambridge Mathematical Tracts, Nos. 6 and 7. (Cambridge: The University Press, 1907.) Price 2*s.* 6*d.* each net.

(1) THE solution of a given equation is a problem which has attracted the attention of many of the greatest mathematicians. In this tract we have a short summary of the results arrived at. The solution depends on the properties of a certain permutation-group called the Galoisian group; if this group is soluble, the equation is solvable by radicals. Interesting types of soluble groups are cyclical, Abelian, and metacyclic groups. To each of the corresponding equations is devoted a chapter in which are explained the application of cyclical groups to cyclotomy, the dependence of Abelian on cyclical equations, and Kronecker's solution of the metacyclic equation. Prof. Mathews's masterly epitome of the subject is not very easy reading, and he assumes some knowledge of Tschirnhausen's transformation, the theory of permutation-groups, &c. The student will probably have to prepare himself for the study of this tract by reading some more elementary treatise on the same subject (*e.g.* Dickson's "Algebraic Equations"), and some book on groups, such as Burnside's.

(2) Dr. Whittaker does not follow Prof. Mathews in writing for the advanced mathematician, but appeals in the first place to those students of physics to whom mathematics is interesting chiefly for its applications. The professed object is to give "a simple theoretical account of those defects of performance of optical instruments to which the names of coma, curvature of field, astigmatism, distortion, secondary spectrum, want of resolving power, &c., are given." Limitations of space necessitate in places proofs which, though clear, are rather too concise; but except for this the beginner will find the tract fairly straightforward reading. The author has succeeded in producing a book which will prove remarkably interesting, not only to the user of optical instruments, but also to any student of mathematics. The leading principles and results are very attractively presented, and can be readily grasped without plodding through every detail of the somewhat laborious approximations which the subject at times requires. H. H.

Detection of the Common Food Adulterants. By E. M. Bruce. Pp. vii+84. (London: A. Constable and Co., Ltd., 1907.) Price 5*s.* net.

THE United States used popularly to be looked upon as *par excellence* the land of wooden nutmegs and similar examples of perverted manufacturing ingenuity. Perhaps, therefore, it is fitting that what our author calls "the great pure food reform" should find especial favour there. Be that as it may, there has undoubtedly arisen in the States a quickening of interest in the matter of food adulteration; wherefore Mr. Bruce speaks of health officers, food inspectors, chemistry teachers, and even students being constantly called upon to test the purity of various foods —at whose instance is not quite clear. He proposes to help them and others in this task, which he says

"usually involves nothing more than making simple qualitative tests for adulterants," by bringing together in one small book the best and simplest qualitative methods of detecting all the common sophistications of foodstuffs.

As a collection of recipes the work is good; in other respects it commands but qualified admiration. For the glorified cookery-book in chemical literature we have no great liking, and this compendium of "tests" is little more. The numerous pitfalls which beset the unwary are rarely indicated in the directions given; and the reasons for the various operations are left for the operator to discover for himself. Now this is well enough if the person using the book is already a master of his craft, knowing the pitfalls and how to avoid them, cognisant of the why and wherefore of his procedure, and only employing the work as a convenient collection of notes wherewith to refresh his memory when applying the various processes. But in the hands of the unpractised person, whether student or "inspector," it is quite another matter. Differences of conditions, apparently slight, may lead him wholly astray. It would be well enough for the enthusiastic student or teacher to test his breakfast bacon for borax, or his morning milk for added water, provided he does it merely for his private information; only in that case it would not benefit the pure-food movement much. But if he is going to lodge a serious complaint on the strength of his discoveries, it would be well, also, first to have those discoveries confirmed by a practised analyst. Otherwise there may arise unpleasant references to the law of libel.

The experiments are well selected and tersely described. As a compendium of some of the best qualitative tests for ordinary food-adulterants the book will be useful, especially to the man who already knows how to apply the processes. C. S.

Altitude Tables. Computed for Intervals of Four Minutes between the Parallels of Latitude 0° and 30°, and Parallels of Declination 0° and 24°. Designed for the Determination of the Position Line at all Hour Angles without Logarithmic Computation. By Frederick Ball. Pp. xxxiii+245. (London: J. D. Potter, 1907.) Price 15*s.* net.

SINCE the notice of the first part of this work appeared in NATURE of February 20, the companion volume for latitudes 0° to 30° has been published, making these tables complete between the parallels of 60° N. and 60° S. By their means the navigator can with facility and rapidity determine his position by the observation of any heavenly body the declination of which does not exceed 24°, and, as the latitude and declination are interchangeable in the tables, they are consequently available for all stars up to 60° in declination between 24° N. and 24° S.

This valuable contribution to scientific navigation will be appreciated by all navigators who employ the "New Navigation"—Captain Marcq St. Hilaire's method—as a practical and direct help in saving the tedious computation of the altitude required in the problem. The tables will undoubtedly tend to popularise that excellent method, which has hitherto been neglected by so many navigators, mainly on account of the lengthy calculations entailed, and more especially when it is realised that their practical utility equals their mathematical exactness.

The introduction to each volume fully explains the various uses of the tables, so that no difficulty need be experienced when employing them. The book is of a handy size and well bound, with clear type well arranged and spaced, so that the navigator with but little light and limited time will find a pleasure in using it. MIREMONT.

Logarithmic and Other Tables for Schools. By Frank Castle. Pp. 36. (London: Macmillan and Co., Ltd., 1908.) Price 6*d.*

THE introduction of more practical methods in the teaching of mathematics in schools has led to an increasing demand for inexpensive tables of logarithms, values of trigonometric functions, and other data which pupils are now encouraged to use at quite an early stage of their mathematical work. Mr. Castle has compiled a series of four-figure tables which will meet every need of mathematical classes in schools, and be of great service in school laboratories. The tables include logarithms and antilogarithms, natural and logarithmic sines, cosines and tangents, degrees to radians and radians to circular functions, hyperbolic logarithms, powers, roots and reciprocals, and exponential and hyperbolic functions. The type is clear and the style attractive, and these qualities, combined with the wide scope and low price, should ensure a wide popularity for the tables.

Praise of a Simple Life. Edited by E. A. Baker. Pp. x+258. (London: George Routledge and Sons, Ltd., n.d.) Price 2*s.* 6*d.* net.

MR. BAKER has compiled a collection of extracts on the theme of a life according to nature from classical writers to the end of the eighteenth century. These utterances are arranged in four sections, which the editor calls respectively the antique world, the dawn of a new age, the age of expansion, and the age of reason. More than four-score authors are drawn upon, so that the reader is provided with a diversity of points of view. The volume is dainty, will go into the pocket, and should be a favourite with readers of poetic temperament.

LETTERS TO THE EDITOR.

[The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts intended for this or any other part of NATURE. *No notice is taken of anonymous communications.]*

On the Radio-activity of Potassium and other Alkali Metals.

IN the course of some experiments made by them on the radio-activity of a series of salts which had hitherto been considered inactive, Messrs. Campbell and Wood (Proc. Camb. Phil. Soc., vol. xiv., part i., p. 15, 1907) found that potassium salts exhibited a radio-activity greater than that of any other substance previously examined which did not contain any of the so-called radio-active elements.

In seeking for the source of this activity, these experimenters found it impossible to separate out any active impurity from the salts examined, and they were led by the results of their investigation, which included measurements on the activities of a limited number of the compounds of potassium, to conclude that the activity originated with the potassium itself, and was an atomic property of that metal.

In a later paper (Proc. Camb. Phil. Soc., vol. xiv., part ii., 1907) Campbell described some additional experiments dealing with the character of the radiation emitted by the potassium salts, and in concluding expressed the opinion that the radiation consisted of β rays possessing an average velocity less than that of the β rays of uranium.

During the last few months the writer, in collaboration with Mr. W. T. Kennedy, has made, in the Physical Laboratory at Toronto, a close examination of the radio-activity of a large number of potassium and other salts, and while the results of this examination confirm the discovery of Campbell and Wood that potassium salts generally possess an exceptionally high activity and emit a radiation possessing considerable penetrating power, they